Management of Severe Heart Failure Exacerbation

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Presenter Disclosure Information

• I will not discuss off label use or investigational use in my presentation.
• I have financial relationships to disclose:
  – Employee of: University of Colorado
  – Consultant for: J&J/Janssen, Novartis, Boston Sci, Amgen
  – Stockholder in: None
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  – Honoraria from: None

Learning Objectives

1. Name clinical findings that distinguish severe HF from garden-variety HF.
2. Understand the initial approach to stabilizing severe HF.
3. Know when to call for help, and what higher-level care options exist for severe worsening HF.
We All Know Heart Failure Hospitalizations Are Bad

Common
>1 million annually

Costly
>$18 billion annually

Deadly
10% at 30 days

Some HF Hospitalization are Worse than Others

Acute Worsening HF
Inadequate CO
Hypotension
Hypoperfusion
Tissue Ischemia
Multi-Organ Failure

What is a Severe Heart Failure Exacerbation?

WHAT'S IN A NAME?
WELL, ACTUALLY THERE'S LENTY...
Severe Heart Failure Exacerbation: 2 flavors

**Shock**
Acute loss of cardiac output

**End-Stage (D) HF**
When adaptive mechanisms have finally failed

*Cardiogenic Shock*

- Clinical condition resulting from inadequate tissue (end-organ) perfusion due to cardiac dysfunction
- Clinical Symptoms: cool extremities, decreased urine output, and/or alteration in mental status
- Labs: Lactate>4, AST or ALT>1000, SVO2<50%, ↑BUN/Cr, ↓Na
- Hemodynamic definition parameters:
  - Persistent hypotension: SBP<80-90mmHg or MAP 30 mmHg lower than baseline) AND
  - Severe reduction in cardiac index (<1.8 L/min/m² without support or <2.0-2.2 L/min/m² with inotropic support) AND
  - Adequate or elevated filling pressure (eg, LVEDP>18 mmHg or RVEDP>10-15 mmHg)

*End-Stage (D) HF*

*Box 1. Heart Failure Society of America Definition of Advanced (Stage D) Heart Failure*

The presence of progressive and/or persistent severe signs and symptoms of heart failure despite optimized medical, surgical, and device therapy. It is generally accompanied by frequent hospitalization, severely limited exercise tolerance, and poor quality of life and is associated with high morbidity and mortality. Importantly, the progressive decline should be primarily driven by the heart failure syndrome.
Transition to Advanced Heart Failure:

• Oral therapies failing
• A time for many major decisions

Onset of CHF

Quality of Life

Clinical Course

Stage C — Stage D

AHA Scientific Statement

Decision Making in Advanced Heart Failure
A Scientific Statement From the American Heart Association

Reversible

- Fulminant myocarditis
- Nonadherence to medications
- Dietary indiscretion +/-
- Drug or alcohol abuse
- Coronary ischemia
- Anemia
- Thyroid disorder (amio) (not euthyroid sick syndrome)
- Infection
- PE
- etc

Irreversible

- Infarction (trop 500)
- Worsening heart failure

2 Hearts: Consider RV v. LV Failure
Advanced HF Rarely Occurs in Isolation

1) Advanced age (median HF hosp 78 years)
2) Comorbidity (50% 5+ diagnoses)

Hospitalist:
When to ask for help?

HF Doc:
When to implant LVAD?

I-NEED-HELP

I: IV inotropes
N: NYHA IIIB/IV
H: Natriuretic peptides persistently elevated
E: End-organ dysfunction
D: Ejection fraction <25%
F: Defibrillator shocks
L: Hospitalizations >1
E: Edema, escalating diuretics
O: Low blood pressure, high heart rate
P: Prognostic medication – progressive intolerance or down-titration of GDMT

• Right heart cath? Palliative care?
• Referral to Advanced HF Center?
High BNP
Hypotension
Renal dysfunction

TROUBLE!


Adjusted heart failure hospitalization-free survival

Lower BNP

Rx

Don't just stand there. Do something.
4-quadrant clinical assessment HF

- A: No - Warm and Dry
  - Happiness

- B: Yes - Warm and Wet
  - Dry out (diuretic) +/– vasodilate

- C: Yes - Cold and Wet
  - Inotrope? LVAD, Transplant?? Hospice

- D: No - Cold and Dry
  - HF challenge

Regardless of HF Type, Diuresis PRN

- HFrEF (LVEF < 40%)
- HFP EF (LVEF > 50%)
- RV Failure

Volume Control

IV diuretics: 90% of HF hospitalizations, 70% only Rx Δ is IV loop diuretic
Choices, but do they matter?

Which loop diuretic?

Bolus v. Infusion?

Which augmentation?

Metolazone Tablets, USP

2.5 mg

Role of PA Catheters?

The Routine Use of the Pulmonary Artery Catheter Should Be Abandoned

Yes!

The Use of the Pulmonary Artery Catheter Should Be Abandoned

No
Diuretic Dosing

- History (weights, Sx)
- Exam (JVD, edema, orthostatics)
- Trial and error
  - Can diurese almost anyone with enough IV loop diuretic and metolazone
  - Can give back IVF
- RHC
  - May be useful when “lost”
    e.g. volume and renal status conflict
  - (Necessary for txplt/LVAD eval)

Inotropes

BB v. Beta-Agonism

<table>
<thead>
<tr>
<th>Congestion at rest?</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Warm and dry</td>
<td>Warm and Not</td>
</tr>
<tr>
<td>Yes</td>
<td>Cold and dry</td>
<td>Cold and Not</td>
</tr>
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</table>

- Warm up (inotrope), then dry out
- Continue full-dose BB
- Half-dose BB
- Hold BB
- Start dobutamine (or norepinephrine if SVR/BP very low; drop with dobut) and hold BB and call for help.
Positive Inotropic Agents

Stroke Volume

Ventricular End-Diastolic Pressure

↑Contractility

Also increase HR, so CO ↑↑↑

Improves symptoms short-term

Long-term HF is worsened

Which inotrope?

For cardiogenic shock (low output, high SVR):

- Generally start with dobutamine.
- If BP tanks add/switch to norepinephrine.
- Call for help.

SOAP-II

<table>
<thead>
<tr>
<th>Days since Randomization</th>
<th>No. at Risk</th>
<th>Norepinephrine</th>
<th>Dopamine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>801</td>
<td>808</td>
</tr>
<tr>
<td>1</td>
<td>617</td>
<td>555</td>
<td>487</td>
</tr>
<tr>
<td>2</td>
<td>584</td>
<td>412</td>
<td>412</td>
</tr>
<tr>
<td>3</td>
<td>487</td>
<td>412</td>
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</tr>
<tr>
<td>4</td>
<td>407</td>
<td>356</td>
<td>356</td>
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KISS

KEEP IT SIMPLE STUPID

No. of Risk

Norepinephrine: 801 617 555 487 412 412 356
Dopamine: 808 611 546 484 432 416 357

**Beta-Agonism v. Antagonism: ACUTE v. CHRONIC**

<table>
<thead>
<tr>
<th>Acute (Unstable)</th>
<th>Chronic (Stable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine</td>
<td>Metoprolol Succinate</td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>Dopamine</td>
</tr>
<tr>
<td>Dopamine</td>
<td>Milrinone</td>
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**2013 ACCF/AHA HF Guidelines**

<table>
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<tr>
<th>Performance Improvement Systems in the Hospital and Early Postdischarge Outpatient Setting to Identify HF for GDMT</th>
<th>I B</th>
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<tr>
<td>Before hospital discharge, at the first postdischarge visit, and in subsequent follow-up visits, the following should be addressed:</td>
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<tr>
<td>a) initiation of GDMT if not done or contraindicated;</td>
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<td>b) causes of HF, barriers to care, and limitations in support;</td>
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</tr>
<tr>
<td>c) assessment of volume status and blood pressure with adjustment of HF therapy;</td>
<td></td>
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<tr>
<td>d) optimization of chronic oral HF therapy;</td>
<td></td>
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<tr>
<td>e) renal function and electrolytes;</td>
<td></td>
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<tr>
<td>f) management of comorbid conditions;</td>
<td></td>
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<tr>
<td>g) HF education, self-care, emergency plans, and adherence; and</td>
<td></td>
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<tr>
<td>h) palliative or hospice care.</td>
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<tr>
<th>Multidisciplinary HF Disease Management Programs for Patients at High Risk for Hospital Readmission are Recommended</th>
<th>I B</th>
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<td>A follow-up visit within 7 to 14 days and/or a telephone follow-up within 3 days of hospital discharge is reasonable</td>
<td>IIa B</td>
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<tr>
<th>Use of Clinical Risk Prediction Tools and/or Biomarkers to Identify Higher-Risk Patients is Reasonable</th>
<th>IIa B</th>
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**Chronic (Stable)**

- HFrEF (LVEF < 40%)
- HFP EF (LVEF > 50%)
- RV Failure

**Think long-term and where you CAN make a difference**
Temporary “Bailout” MCS Options

- Intra-aortic balloon pump (IABP)
- Impella
- Extracorporeal membrane oxygenation (ECMO)
Temporary Mechanical Circulatory Support: A Necessary Evil

**BENEFITS**

- **TIME!!!**
  - Stabilization and preservation of organ function (e.g., renal perfusion to avoid ATN)
  - Myocardial recovery in cases of reversible causes of shock (e.g., viral myocarditis)
  - Bridge to definitive Advanced HF treatments (Transplant, LVAD)
  - Transfer to center that offers Transplant or LVAD

**CONS**

- **TIME**: Short term of days to weeks, cannot be discharged home
- Complications including bleeding (often requiring blood products), infections, vascular access injury, surgical placement of some devices
- Costly including prolonged ICU stay
- Higher morbidity and mortality after transplant and LVAD compared to patients without prior temporary MCS
- Use should be minimized in chronic HF patients by appropriate timing of transplant and/or LVAD

Rapid Rise in All Temporary MCS
Irreversible Group Growing Fastest

Advanced HF Treatments: Summary

- Profile 1—Cardiogenic Shock
  - Temporary MCS has an important role in the treatment of patients with cardiogenic shock, but comes with a risk of complications.
  - Temporary MCS devices are a temporary bridge to something... (recovery, LVAD, transplant).
    - It is important to have a "Plan B" lined up
    - If you are placing an IABP or Impella after a late presentation of Anterior MI w/ Trop>500 upon arrival to the ED, what is the expected recovery and next step?
- Profile 2-3—Intravenous Inotropes
  - Benefit/Risk ratio greatly favors LVAD and Transplant in appropriate patient
- Profiles 4-7—Ambulatory, Advanced HF, Oral Therapies (I-NEED-HELP patients)
  - High risk for poor outcomes—only 53% alive on medical therapy at 1 year
  - Start discussions about LVAD, Transplant, and Advanced Directives/Life-Sustaining Therapies
Question #1

In a patient who is admitted to the hospital with worsening heart failure (regardless of LVEF), which blood pressure would give you the greatest reassurance that the patient will do well in the coming days?

A. 140/90
B. 130/100
C. 120/80
D. 110/70
E. 90/70

A higher systolic pressure and a good pulse pressure suggest a reasonable stroke volume. Acutely, low blood pressure and low pulse pressure can be a reflection of poor cardiac function. Additionally, many of the therapies used to improve symptoms can further lower blood pressure acutely.

Question #2

Which of the following is LEAST suggestive of impaired cardiac output / a low flow state in a patient with worsening heart failure?

A. Cool extremities
B. Tachycardia
C. Hypotension with narrow pulse pressure
D. Rising creatinine following diuresis
E. Elevated jugular venous pressure
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Elevated right-sided pressures indicate congestion but not necessarily significantly impaired output. Most patients hospitalized with volume overload can be treated with IV diuresis without augmentation of inotropy.